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BERGGREN

14 June 2005

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REPLY TO WRITTEN OPINION
INTERNATIONAL PATENT APPLICATION PCT/FI2004/000476
APPLICANT: KEMIRA OYJ
DUE DATE:

On account of the Written Opinion issued on 10 December 2004 we submit the following:

The written opinion refers to three documents, which are

D1: [Online] XP00230691 Retrieved from internet: URL:http:bama.ua.edu/~rdrogers/sandiego/ >[retrieved on 2001-04]
D2: WO 03/029329 A (PG RES FOUNDATION INC; UNIV ALABAMA (US)) 10 April 2003 (2003-04-10)
D3: US-A-4 000 032 (Bergstrom John Rickard et al) 28 December 1976 (1976-12-28).

It is now in respect of document **D1**, the Examiner states the subject-matter of present claims 9-11 being not novel. Document **D1** is considered to represent the closest prior art. When combined with documents **D2** and **D3** the present invention is not regarded to involve an inventive step.

The applicant now wishes to respond the following:

Novelty

The Examiner states none of the documents **D1**, **D2** or **D3** disclose dissolving lignocellulosic material in the presence of an ionic solvent and with the help of either microwaves or pressure, and consequently, finds the subject matter of present claims 1-8 and 12-22 being novel.

According to the Examiner, **D1** discloses the dissolution (at least partial dissolution) of lignocellulosic material with the help of ionic solvents. **D1** as such is an URL-page for 221st American Chemical Society National Meeting, which discloses an abstract titled "*Reactivity of lignocellulosic biomass **derivatives** in ionic liquids*" (XP002306103) by Moens et al.

Explicitly, said abstract comprises a study of reactivity of already once chemically converted lignocellulosic biomass derivatives, whilst the present invention comprises dissolution of native lignocellulosic material, not it's derivatives. Quite the contrary, the term "lignocellulosic material" as applied in the present invention refers to a *natural, **untreated** material* containing cellulose and lignin that has not been subjected to any chemical processes (please see p. 6, lines 16-17 and p. 10, lines 9-17).

Consequently, the resulting solutions have clearly different compositions and nature, the subject-matter of present invention and claims 9-11 being thus novel with respect to **D1**.

Inventive step

Invention compared to D1

The Examiner states the differentiating feature between the subject-matter in the present invention and the disclosures of **D1** being that the present application claims the application of either microwave radiation or pressure during the dissolution step. Thus, according to the Examiner the objective problem should be regarded as merely providing an alternative, since the applicant has not shown that this additional step is in any way useful, or even necessary.

As argued earlier in the discussion of novelty, the present invention provides a method for dissolving untreated (natural) lignocellulosic material in ionic liquids, not for dissolving chemically pre-modified lignocellulosic biomass derivatives as encouraged in **D1**.

Thus, **D1** teaches that it is necessary to pre-modify lignocellulosic material chemically prior dissolving and converting it further into series of different chemicals. The description of "dissolution step" in **D1** is implicitly disclosed, giving no further information about the required applications, dissolution degree of lignocellulosic derivatives or even the nature of ionic liquids employed in the assumed "dissolution".

Also contrary to **D1**, the dissolved components of lignocellulosic material remain essentially the same, accomplishing the separation of dissolved intact species.

Invention compared to D2

D2 provides a method for dissolving pure cellulose in an ionic liquid assisted with microwave irradiation.

Due to the different chemical nature of cellulose and lignin as well as different extractives in wood, straw and any other natural lignocellulosic materials, the man skilled in the art would not expect there would be any such solvents that could dissolve all said components simultaneously.

Thus, **D2** does not contain any teaching or an incentive for dissolving lignocellulosic or any other materials in ionic liquids either.

Invention compared to D3

D3 provides a method for freeing cellulose fibers from lignocellulosic material, which comprises subjecting particulate lignocellulosic material to microwave irradiation at such an intensity that the water present in the lignocellulosic material is rapidly and even explosively vaporised, and disrupts the natural structure of the lignocellulosic material, thereby freeing the fibers substantially without deterious effect upon the length or strength of the fibers.

According to **D3** (column 3, lines 38-51), the lignocellulosic material should have a water content of at least about 10% up to about 90%, preferably from about 25% to 90% by weight.

The main differentiating features from the present invention are that **D3** does not contain any dissolving step of lignocellulosic material, there are no ionic liquids involved and the disruption method requires excessive contents of water in order to facilitate the freeing of cellulose fibers.

D3 does not contain any incentive of the possibility to dissolve the lignocellulosic material, not into ionic liquids or any other media either. On the contrary, **D3** teaches how to avoid any unnecessary dissolution of lignocellulosic material in order to free cellulose fibers from lignocellulosic material in high yield. This is achieved with high water contents of lignocellulosic material and microwave-assisted disruption of said material, which is against the features of present invention, wherein the dissolution of lignocellulosic material must be carried out in the substantial absence of water.

Obviousness in combining D1, D2 and D3

The Examiner argued that it would have been obvious for the person skilled in the art, when attempting to find an alternative dissolution method, to investigate the applicability of microwaves when dissolving lignocellulosic material with ionic solvents.

As opposed earlier, the dissolution method according to the present invention is not an alternative but a novel method to dissolve lignocellulosic material. Combining **D2** with **D1** teaches that the dissolution of different large natural polymers and compositions thereof either requires the chemical modification of lignocellulosic material prior dissolution attempts or dissolution of pure natural polymer components. Combining further **D3** with the latter teaches how to avoid dissolution of lignocellulosic material associated with traditional pulping methods in liquid media by treating the lignocellulosic material with microwaves in water. This teaching is outbound from the present invention.

Reconsideration of the statement with regard to novelty and inventive step of the present set of claims is thus respectfully requested.

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